



# **CVG-606xl**

**6x6 Video/Audio Matrix Switcher**

# **CVG-808xl**

**8x8 Video/Audio Matrix Switcher**

## **USER MANUAL**

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## 1 INTRODUCTION

Congratulations on purchasing your Matrix Switcher. This user manual describes the following products:

<i>CVG-606xl</i>
<i>CVG-808xl</i>

### 1.1 A Word on Video/Audio Switchers

A video/audio switcher usually switches between several sources (inputs) and one or more acceptors (outputs). A switcher that allows several inputs to be connected to several outputs simultaneously is called a Matrix Switcher. Switchers may be of the electronic or mechanical type. Most matrices are of the active electronic type, with many crosspoints. Vertical Interval Switching, frequently used in video, ensures that the transition from one video source to another (such as switching between two genlocked cameras) is smooth and without interference. The switching and changeover is done during the blanked vertical interval period, when the transition is hidden from the eyes. Vertical Interval Switching is needed when recording or transmitting a video program involving several video sources, as in live broadcast, to ensure clean, undisturbed picture transitions. The switched sources should be genlocked. Matrices and switchers may sometimes be RS-232 or RS-485/422 controlled. Each of these options is a way of remotely controlling a video/audio device (switcher etc.) using a PC with a serial port, or another device that uses a similar communication protocol. The simplest connection between the RS-232 controller and the controlled device uses two wires (TRANSMIT, RECEIVE) and a common ground wire. Finally, the wide video bandwidth permits the Matrix Switchers to be used in the most demanding applications.

### 1.2 Factors Affecting Quality of Results

There are many factors affecting the quality of results when signals are transmitted from a source to an acceptor:

- **Connection cables** - Low quality cables are susceptible to interference, they degrade signal quality due to poor matching and cause elevated noise levels. They should therefore be of the best quality.
- **Sockets and connectors of the sources and acceptors** - So often ignored, they should be of highest quality, since "Zero Ohm" connection resistance is the target. Sockets and connectors also must match the required impedance (75ohm in video). Cheap, low quality connectors tend to rust, thus causing breaks in the signal path.
- **Amplifying circuitry** - Must have quality performance when the desired end result is high linearity, low distortion and low noise operation.
- **Distance between sources and acceptors** - Plays a major role in the final result. For long distances (over 15 meters) between sources and acceptors, special measures should be taken in order to avoid cable losses. These include using higher quality cables or adding line amplifiers.
- **Interference from neighboring electrical appliances** - These can have an adverse effect on signal quality. Balanced audio lines are less prone to interference, but unbalanced audio should be installed far from any mains power cables, electric motors, transmitters, etc. even when the cables are shielded.

## 2 SPECIFICATIONS

	CVG-606XL	CVG-808XL
<b>Configuration</b>	6x6	8x8
<b>Input Type</b>	6 composite video, 1 sync/video genlock with sync select switch, 6 stereo audio	8 composite video, 1 sync/video genlock with sync select switch, 8 stereo audio
<b>Input Connections</b>	Video: BNC connectors Audio: RCA connectors	Video: BNC connectors Audio: RCA connectors
<b>Input Level</b>	Composite video: 1Vpp/75ohm, Sync/video genlock: 1Vpp/75ohm Audio: +4dBm/62kohm	Composite video: 1Vpp/75ohm, Sync/video genlock: 1Vpp/75ohm Audio: +4dBm/33kohm
<b>Output Type</b>	6 composite video 6 audio stereo	8 composite video 8 audio stereo
<b>Output Connector</b>	Video: BNC connectors, Audio: RCA connectors	Video: BNC connectors, Audio: RCA connectors
<b>Output Level</b>	Composite video: 1Vpp/75ohm Audio: +4dBm/50ohm (27Vpp max.)	Composite video: 1Vpp/75ohm Audio: +4dBm/50ohm (24Vpp max.)
<b>Video S/N Ratio</b>	74dB	74dB
<b>Audio S/N Ratio</b>	88dB unweighted, (1Vpp)	88dB unweighted, (1Vpp)
<b>Video Bandwidth</b>	Exceeding 200MHz	Exceeding 200MHz
<b>Audio Bandwidth</b>	Exceeding 100kHz	Exceeding 100kHz
<b>Differential Gain</b>	0.05%	0.05%
<b>Differential Phase</b>	0.03Deg.	0.03Deg.
<b>K-Factor</b>	<0.05%	<0.05%
<b>Non Linearity</b>	<0.1%	<0.1%
<b>Video Crosstalk</b>	<-50dB @ 5MHz	<-50dB @ 5MHz
<b>THD</b>	0.016% (1V, 1KHz)	0.016% (1V, 1KHz)
<b>2nd Harmonic</b>	0.004%	0.004%
<b>Switch System</b>	Vertical interval	Vertical interval
<b>Control Type</b>	Manual, RS-232 or RS-485	Manual, RS-232 or RS-485
<b>Power Consumption</b>	11VA	11VA
<b>Weight</b>	3.4 kg (7.5lbs.) Approx.	3.5 kg (7.8lbs.) Approx.
<b>Dimensions (H x W x D)</b>	19" x 7" x 2U	19" x 7" x 2U
<b>Power Source</b>	230VAC, 50/60 Hz, (115VAC, U.S.A.)	230VAC, 50/60 Hz, (115VAC, U.S.A.)

## 3 HOW DO I GET STARTED?

The fastest way to get started is to take your time and do everything right the first time. Taking 15 minutes to read the manual may save you a few hours later. You don't even have to read the whole manual - if a certain section doesn't apply to you, you don't have to spend your time reading it.

## 4 UNPACKING AND CONTENTS

The items contained in your CVG accessory package are listed below. Please save the original box and packaging materials for possible future transportation and shipment of the machine.

- Matrix Switcher
- CD with Control software
- AC Power Cable
- User Manual
- Null Modem Adapter Connector
- 4 Rubber Feet

### 4.1 Optional Accessories

The following accessories, which are available from CVG, can enhance implementation of your machine. For information regarding cables and additional accessories, contact your CVG dealer.

- **BNC "Y" Connector** - Used for looping purposes and splits the incoming signal to enable connection of an additional machine.
- **CVG-KR10D** - (Composite-YC Comb Filter/Transcoder) can be serially connected to a Matrix Switcher for video format conversion (between two popular video formats - composite video and YC (Super-Video)). The decoding from composite to Y/C is done digitally using an adaptive comb filter and DSP techniques to minimize dot-crawl and cross-color. A built-in vertical enhancer circuit reduces noise and dot-crawl on the Y signal. In addition, the **CVG-KR10D** provides an independent Y/C to Composite route, for simultaneous bi-directional operation. The **CVG-KR10D** is very small in size, and is fed from an external 12VDC supply, thus ideal for fieldwork.

## 5 GETTING TO KNOW YOUR MATRIX SWITCHER

Most front/rear panel features of the Matrix Switchers described in this manual are very similar. Therefore, only the **CVG-606xl** is described and it represents the rest of the Matrix Switchers.

### 5.1 Your CVG-606xl Matrix Switcher

The **CVG-606xl** is a broadcast quality, 6x6 Vertical Interval - Audio Stereo Matrix Switcher for composite video and stereo audio signals. They are true matrices, allowing the user to route any input to any or all outputs simultaneously. Since they switch during the vertical interval, transitions are glitch-free when sources share common reference sync. They can switch stereo audio signals in "audio-follow-video" mode or separately (breakaway). Also, the TAKE button allows the user to place multiple switches in a queue, and then activate them with one touch of this button or a single serial command. They have manual, RS-232 and RS-485 controls. Six preset memory locations are provided for quick access to common configurations, and the non-volatile memory "remembers" the last setting prior to being powered-down. The machines have an external Sync/Genlock input as well, and may be programmed to switch according to the timing of either this input or of source number 1. Windows 95/NT (TM) control software is provided free with the machine.

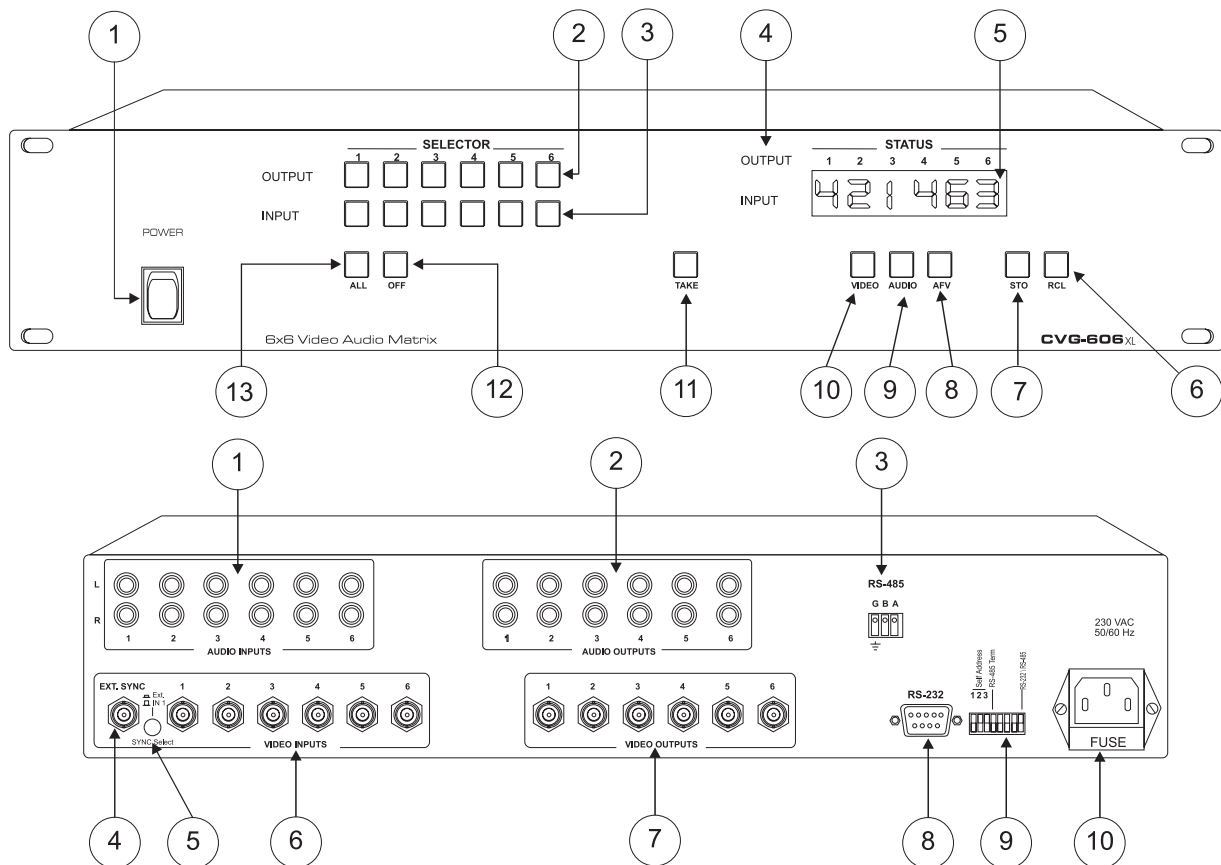
The machines are dependable, rugged, and fit in two vertical spaces of a standard 19" rack. Video bandwidth of 200MHz ensures that the **CVG-606xl** and **CVG-808xl** remain transparent even in the most critical applications

### 5.2 Features of the CVG-606xl and CVG-808xl Matrix Switchers

Front/Rear panel features of the **CVG-606xl** are shown in Figure 1. The features are described in Table 1 and Table 2.

#### NOTE

*For operation instructions refer to section 9.*



**Figure 1: CVG-606x/ Front/Rear Panel Features**

**Table 1: CVG-606x1 Front Panel Features**

No.	Feature	Function
1.	<b>Power Switch</b>	Illuminated switch: supplies power to the unit.
2.	<b>OUTPUT SELECTOR</b> buttons	Select the desired output that the input signal is switched to.
3.	<b>INPUT SELECTOR</b> buttons	Select the desired input to be switched to the output.  <b>NOTE</b> <i>Pressing input buttons "1", "2" and "3" together resets the machine and performs a 7-segment display test.</i>
4.	<b>OUTPUT STATUS</b> labels	Identifies a crosspoint between each output and the input below it.
5.	<b>INPUT STATUS</b> display	Displays the selected input switched to the output (marked above each input).
6.	<b>RCL</b> illuminated button	Should be pressed, followed by an input or output pushbutton to select a predetermined setup (1-6 available setups for the CVG-606x1 and 1-8 setups for the CVG-808x1. For example, press <b>RCL</b> followed by <b>INPUT 4</b> button to recall Setup # 4 from the non-volatile memory.

No.	Feature	Function
7.	<b>STO</b> illuminated button	Should be pressed, followed by an input or output pushbutton to store the current status in the non-volatile memory. For example. Press <b>STO</b> followed by <b>INPUT 4</b> button to store Setup # 4 in the non-volatile memory.  <b>NOTE</b> <i>To delete a setup from the memory, press the <b>STO</b> and <b>RCL</b> buttons simultaneously, followed by the input button (Setup number) to be deleted.</i>
8.	<b>AFV</b> illuminated button	When pressed, illuminates and selects the " <b>Audio Follow Video</b> " function. If the audio configuration differs from the video configuration, the <b>INPUT STATUS</b> display flashes the audio outputs that are to be reconfigured for <b>AFV</b> operation. In such case, the <b>TAKE</b> button must be pressed to confirm the modification.
9.	<b>AUDIO</b>	When pressed, illuminates and selects the audio mode (Breakaway) to enable modification of the audio crosspoints.
10.	<b>VIDEO</b>	When pressed, illuminates and selects the video mode (Breakaway) to enable modification of the video crosspoints.
11.	<b>TAKE</b>	The machines can operate either in " <b>Take</b> " mode or in " <b>Normal</b> " (no user confirmation for each action is needed) mode. Pressing the <b>TAKE</b> button toggles the mode, and the button illuminates when in " <b>Take Mode</b> ". In " <b>Take Mode</b> ", any action would cause the <b>TAKE</b> button to blink before implementation, and the user is required to press <b>TAKE</b> again in order to implement the operation.  <b>NOTE</b> <i>To cancel any operation initiated by pressing a button, press the same button again.</i>
12.	<b>OFF</b>	When pressed after pushing an output button, disconnects that video/audio output from the video/audio input. To disconnect all the outputs, press the <b>ALL</b> button followed by the <b>OFF</b> button.
13.	<b>ALL</b>	When pressed followed by an input button, connects that audio/video input to all audio/video outputs.

**Table 2: CVG-606xl Rear Panel Features**

No.	Feature	Function
1.	<b>1-6 AUDIO INPUTS</b> RCA connectors	Audio inputs used to connect the stereo audio input sources.
2.	<b>1-6 AUDIO OUTPUTS</b> RCA connectors	Audio outputs used to connect the stereo audio output acceptors.
3.	<b>RS-485</b> terminal block	Used for bi-directional communication with another Matrix Switcher or PC through RS-485 interface (see section 9.4 for more details concerning the <b>RS-485</b> operation).
4.	<b>EXT. SYNC</b> BNC connector	Used for connection of an external video sync input. The external sync input can be selected by the <b>SYNC Select</b> switch.
5.	<b>SYNC Select</b> switch	Selects either an external sync from the external source, or internal sync, which is normally inputted via the <b>VIDEO INPUT #1</b> connector (see section 9.3.1 for more information concerning the sync selection).
6.	<b>VIDEO INPUTS</b> BNC connectors	Video inputs used to connect the video sources.
7.	<b>VIDEO OUTPUTS</b> BNC connectors	Video outputs used to connect the video acceptors.
8.	DB-9 female <b>RS-232</b> connector	Used for control of the Matrix Switcher (see section 9.4 for more details concerning the RS-232 operation) from a PC, or remote control device, through an RS-232 interface and a null-modem adapter (provided with the machine).  <b>NOTE</b>



No.	Feature	Function
		<i>Operation of the machine from a remote PC may be done using the control software (provided with the machine).</i>
9.	<b>Setup</b> DIP switches	Allow proper configuration of the control signals received and transmitted through the RS-232 (or RS-485) control port, master/slave modifications, line termination and device ID numbers.
10.	Power Connector	A 3-prong AC connector allows power to be supplied to the unit. Directly underneath this connector, a fuse holder houses the appropriate fuse.

## 6 INSTALLATION

### 6.1 Rack Mounting

Each of the Matrix Switchers described in this manual may be rackmounted in a standard 19" (1U) EIA rack assembly and includes rack "ears" at the ends of the front panel. These devices do not require spacing above or below the unit for ventilation. To rack mount any of the Matrix Switchers, simply place the unit's rack ears against the rack rails of the rack, and insert standard screws through each of the four corner holes in the rack ears.

## 7 CONNECTING TO VIDEO DEVICES

Video sources and output devices (such as monitors, or recorders) may be connected to the Matrix Switchers through the BNC type connectors located on the back of the unit. Bear in mind that the output signal format will match that of the input signal format.

All signal connections that use more than one cable interconnecting between devices should be of equal length. (Example: cables between a camera and the machine should be equal in length).

## 8 CONNECTING TO AUDIO DEVICES

Audio sources and output devices (such as amplifiers or recorders) may be connected to the machines through the RCA type connectors (CVG-808XL, CVG-606XL).

## 9 USING THE MACHINES

### 9.1 Powering on the Machine

#### NOTES

1. The machine should only be powered on, after all connections are completed, and all source devices have been powered on. Do not attempt to connect or disconnect any video, audio or control signals to the machine while it is powered on!
  2. The socket-outlet should be near the equipment and should be easily accessible. To fully disconnect equipment, remove power cord from socket.
1. Press the toggle switch on the far left-hand side of the front panel to the ON position. The toggle switch glows.
  2. Operate the acceptors.

### 9.2 Using the Front Panel Controls

The front panels of CVG Matrix Switcher are designed to be simple to operate, and accomplish the basic function of selecting an input source and output device.

#### 9.2.1 Selecting an Output

Output selection on the Matrix Switchers is made by pressing any of the buttons marked "1" through "8" (CVG-808XL), or "1" to "6" (CVG-606XL) on the front panel. These buttons correspond to output connections as marked on the back panel.

### 9.2.2 Selecting an Input

Input selection on the Matrix Switchers is made by pressing any of the buttons marked "1" through "8" (CVG-808XL), or "1" to "6" (CVG-606XL) on the front panel. These buttons correspond to input connections as marked on the back panel.

### 9.2.3 Connecting a Video/Audio Input/Output

To connect a video/audio Input to a specific output, press the desired output button (upper line), followed by the desired input button (lower row).

### 9.2.4 Disconnecting a Video/Audio Input

To disconnect a video/audio Input from a specific output, press the desired output button followed by the **OFF** button. To disconnect all the outputs, press the **ALL** button, followed by the **OFF** button.

### 9.2.5 Connecting a Video/Audio Input to All Outputs

To connect a video/audio Input to all outputs, press the **ALL** button followed by the **INPUT** button corresponding to the input, which is to be routed to all the outputs.

### 9.2.6 Selecting Video/Audio Control (Breakaway)

For audio control only, press the **AUDIO** button. For video control only, press the **VIDEO** button. Note that the **STATUS** window displays audio or video settings in accordance with the selection.

### 9.2.7 Using the Audio Follow Video Mode

To select "Audio Follow Video" mode, press the **AFV** button. Note that if the audio configuration differs from the video configuration, the differing audio outputs blink in the **STATUS** window of the audio display. The **AUDIO** and **TAKE** buttons blink as well, which means that the audio configuration will be modified for AFV operation. Press the **TAKE** button to confirm the modification.

### 9.2.8 Storing a Configuration

To store a configuration, press the **STO** button, followed by input or an output button to mark the setup number. For example, press **STO** followed by **INPUT # 3** button to store the current configuration in **Setup # 3** in the internal non-volatile memory of the switcher. To abort an operation of the **STO** button once it was pressed, press it again.

### 9.2.9 Recalling a Configuration

To recall a configuration, press the **RCL** button, followed by an input or an output button, marking the setup number. For example, press **RCL** followed by **INPUT# 3** button to recall **Setup # 3** from the internal non-volatile memory of the switcher. To abort an operation of the **RCL** button once it was pressed, press it again.

### 9.2.10 Deleting a Setup

To delete a setup, press both the **STO** and the **RCL** buttons followed by the input button corresponding to the setup number, which is to be deleted.

### 9.2.11 Using the Take Function

To activate the "Take" Function, press the **TAKE** button (the **TAKE** button illuminates). After each pressing of the above-mentioned buttons, the **TAKE** button blinks together with the relevant numbers in the **STATUS** display. Confirmation of the action is implemented by pressing the **TAKE** button again (the **TAKE** button then stops blinking). If the **STATUS** display keeps on blinking for one minute (no button is pressed), the function will be aborted. To abort implementing an operation in "Take" mode, press that button which originally caused the display to blink.

### 9.2.12 Resetting the Machine

To reset the machine, press **INPUTS** buttons "1", "2" and "3" simultaneously. The machine resets itself and a 7-segment self-test is automatically performed.

## 9.3 Using the Back Panel Controls

The switcher ID numbers, the RS-232 / RS-485 settings, and the sync source selection are all configured on the back panel of the machine.

### 9.3.1 Selecting the Sync Source

Input sync selection is made using the "Sync Select" button located on the back panel. For an external sync operation, press the "Sync Select" button. For an internal sync operation, release the "Sync Select" button. This modifies the input circuitry to select the required input sync source.

### 9.3.2 Setting the Configuration Switches

Setting the configuration switches is accomplished through a bank of DIP switches located on the back panel of each Matrix Switcher. Table 3 describes the settings and configurations for each of the DIP switches. To set the configuration switches, confirm that power to the Matrix Switcher is OFF, and with a small flathead screwdriver, move the DIP switches to the "ON" or "OFF" position as shown in Table 3 and Figure 3. Master/Slave DIP switches configure the Matrix Switcher for operation in a multiple switcher configuration. If a Matrix Switcher is operating and being controlled independently, it should be assumed that it is operating in the "Master" configuration.

Up to 8 Matrix Switchers may be cascaded for control via a single port by configuring one Matrix Switcher as a "master", or ID number "1", while all the others are assigned as slave Matrix Switchers or an ID other than "1". When RS-232 connection is implemented, **DIP switch # 8** allows you to enable RS-232 communication between the Matrix Switcher and the PC. This is desirable, so that the controlling device "knows" that the controlled device has carried out its instructions. When RS-485 connection is used for communication between the Matrix Switcher and the PC, **DIP switch # 8** should be up ("OFF"). In some applications, it may be desirable for some machines not to reply to instructions received on the RS-232 and RS-485 ports. In this scenario, you would disable the "Reply", or acknowledgement commands. **DIP switch # 5** enables or disables "reply" from the Matrix Switcher to the PC.

In the case of interconnection between more than two RS-485 receivers-transmitters (including PC), the termination resistor must be disconnected on all the devices, except the first and last machines on the communication line. **DIP switch # 4** connects or disconnects the termination resistor.

**Table 3: DIP Switches Configuration**

MACHINE NUMBER	SELF ADDRESS			DIP SWITCH			DIP switch #4	DIP switch #5	DIP switch #6, DIP switch #7	DIP switch #8
	2	1	0	3	2	1				
1. (Master)	0	0	0	ON	ON	ON	"ON"= Connects the termination resistor. "OFF"= Disconnects the termination resistor.	"ON"= Enables reply from switcher to PC. "OFF"= Disables reply from switcher to PC.	Not used	"ON"= Enables RS-232 communication between switcher and PC. "OFF"= Enables RS-485 communication between switcher and PC.
2.	0	0	1	ON	ON	OFF				
3.	0	1	0	ON	OFF	ON				
4.	0	1	1	ON	OFF	OFF				
5.	1	0	0	OFF	ON	ON				
6.	1	0	1	OFF	ON	OFF				
7.	1	1	0	OFF	OFF	ON				
8.	1	1	1	OFF	OFF	OFF				



**Figure 2: DIP switches General View**

## 9.4 RS-232 and RS-485 Operation

Connections made between your switcher and a PC are accomplished using your computer's RS-232 communication port, or by connecting the PC to the RS-485 terminal block connector. Bear in mind that serial

communication between Matrix Switchers is always via RS-485 (see example in Figure 5). The RS-232 port is either a DB-9 (9-pin port) or DB-25 (25-pin port). The cable connecting your switcher to the PC should be wired as shown in Figure 4. A 9-25 pin adapter or 9-9 pin null-modem adapter is included for your convenience. The null-modem adaptor is wired as shown in Figure 4. If using the adaptor (recommended), plug it into the PC's serial port, and connect via a flat-cable from the other end of the adaptor to your switcher. Please keep in mind that it is not recommended to extend an RS-232 signal beyond a length of 30 feet, without the use of an RS-232 to RS-422 converter at both the PC and the switcher.

If five machines and a PC are cascaded together for example, using RS-485 interconnection, disconnect the termination resistors on all machines except the fifth (see Figure 6). For similar setup, without a PC connected on the RS-485 line, disconnect all resistors except for the first and fifth machines.

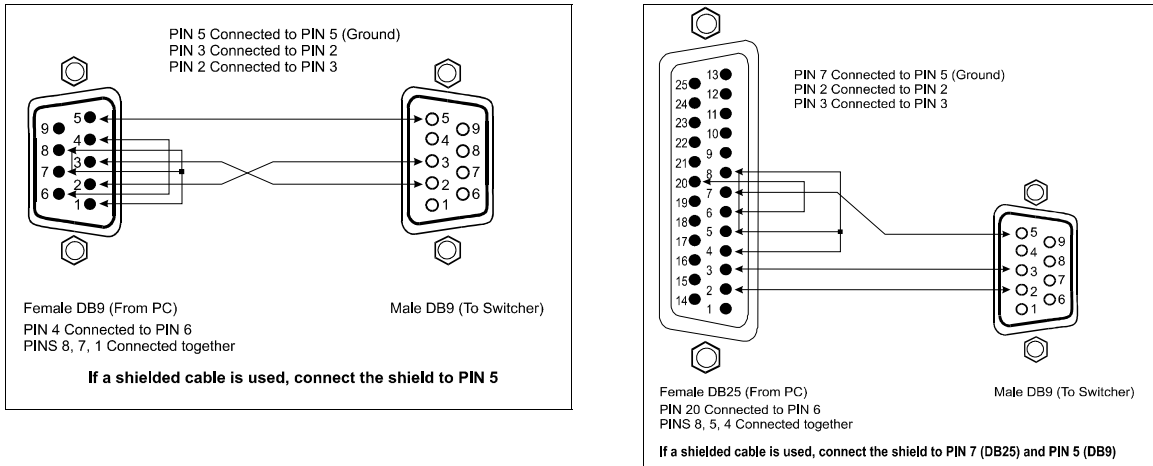


Figure 3: RS-232 Control Connector Wiring

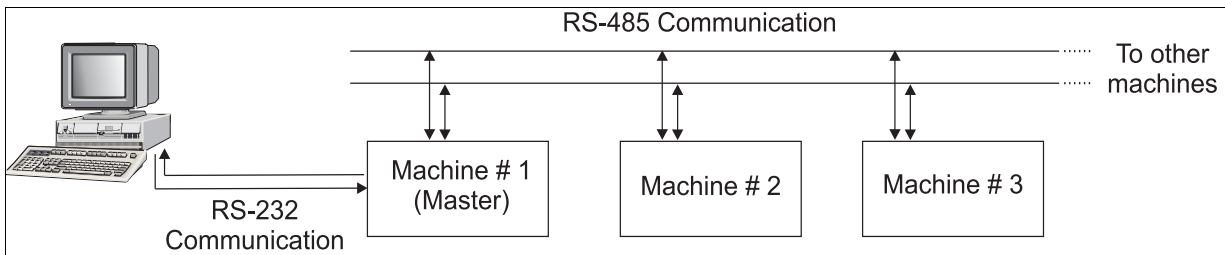


Figure 4: RS-232 and RS-485 Operation

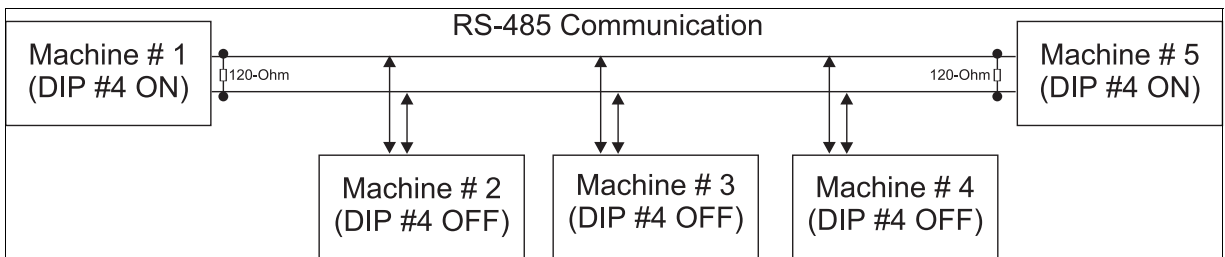


Figure 5: Terminating the Line

## 10 TYPICAL APPLICATIONS

### 10.1 Basic Video-Audio Setup

One of the most common video formats is composite video. Figure 7 describes a typical composite video setup using the CVG-808XL in this case. Three video-audio sources, three video-audio acceptors, and a genlock source are connected to the machine, while control of the Matrix Switcher is implemented via the PC using RS-232 communication.

Perform the following steps (as necessary):

1. Connect all video-audio sources to the video-audio inputs of the Matrix Switcher.
2. Connect all video-audio acceptors to the video-audio outputs of the Matrix Switcher.
3. Operate the Matrix Switcher, PC sources and acceptors.
4. Select the required video input to be switched, using front panel input selector pushbuttons (or the software program controls).

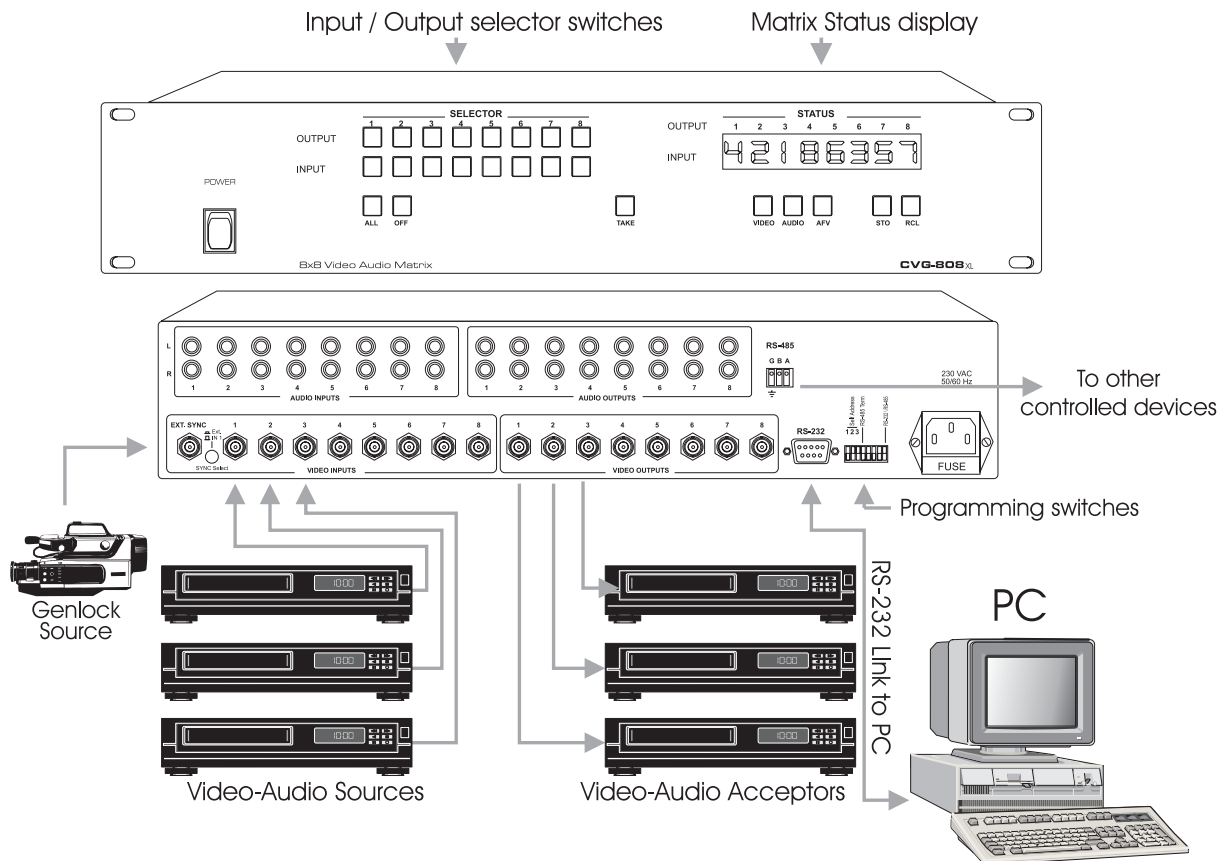


Figure 6: Basic Video-Audio Setup

### 10.2 Component Switching using Multiple Matrix Switchers

A commonly used video format is component video, and switching the three signals (components) simultaneously is sometimes a complicated task. Using several **Matrix Switchers**, however, this can be done very easily and efficiently. This is done by dedicating each switcher to a single component.

For example, for an 8 input, 8 output RGBS matrix switcher, 4 CVG-808xl's would be used – one for the Red component, one for Green, one for Blue, and one for Sync. Each component of the RGBS signal is then connected to the **same** input (or output) number on the switcher. For example, the first RGBS source is connected to Input #1 on the 4 switchers, the second is connected to Input #2 on the switchers, etc. The switchers are configured to mirror each other, so the input to output connections are identical on all 4 machines! In order to switch during the vertical interval when working in this way, the switchers should be configured for operation using the "Ext. Sync". A sync source should then be connected to all the machines (for RGB this could be the Green channel, and for YUV this could be the Y channel).

The examples below detail the building of RGB matrices. The same principles may be used for YC (2 switchers), YUV (3 switchers), RGS (4 switchers), and RGBHV (5 switchers).

### 10.2.1 RGB/YUV Switching with RS-232 (e.g. PC Control)

For RS-232 control of the component matrix switcher, an additional piece of equipment would be required. Since RS-232 can only be used for control between 2 pieces of equipment (e.g. a PC and a switcher), we need a method of “distributing” the RS-232 to all 3 machines. The CVG-14 “RS-232 Port Extender” is designed for this purpose.

Perform the following steps (as necessary):

1. Connect the RGB sources to the **VIDEO INPUTS** connectors of the Matrix Switchers, connecting the “R” components to Matrix Switcher #1, “G” to #2, and “B” to #3. Make sure that each component of a video source is connected to the same input number on the three switchers.
2. Similarly, connect the RGB acceptors to the **VIDEO OUTPUTS** connectors of Matrix Switchers #1 to #3.
3. If the video sources are synchronized, and vertical interval switching is desired, connect sync sources to all 3 machines, and select to work with “Ext. Sync” (selector switch pressed in).
4. Assign all 3 machines as machine number #1 (see Table 3: “DIP Switches Configuration” for more information).
5. Set **DIP switch #5** (Reply) of the first machine to “ON”. Set to “OFF” for the other machines.
6. Set **DIP switch #8** of all the machines to “ON” (RS-232 communication between switchers and external controller).
7. Connect the serial port of the PC to a port on the CVG-14, and connect each switcher to a CVG-14 port. Configure the DIP-switches of the CVG-14 for the 4 ports which were connected.
8. Operate the Matrix Switchers, PC, CVG-14, RGB sources and RGB acceptors
9. The inputs can now be switched to the outputs. This is done via the front panel switches of the **first** switcher, and/or via the PC.

### 10.2.2 RGB/YUV Switching with RS-485 Control (or no External Control)

Communication between the switchers is implemented via RS-485, which could also be extended to an external controller.

Perform the following steps (as necessary):

1. Repeat steps 1-3 of section 10.2.1.
2. Connect the **RS-485** terminal block connectors of all the Matrix Switchers in parallel using RS-485 cable, and connect to also an external controller if required.
3. Assign all the machines with the **same** machine number - but **NOT** machine #1 - using the DIP switches located at the back of the machine, (as described in Table 3: “DIP Switches Configuration”).
4. NOTE: The machines are all assigned as **slaves** having the same machine number. A **master** machine is not assigned.
5. Set **DIP switch #4** (RS-485 termination) of the third machine to “ON” and of the second machine to “OFF”. If an RS-485 external controller is connected, then **DIP switch #4** of the first machine should be set to “OFF”; if no external controller is used, set this switch to “ON”.
6. Set **DIP switch #5** (Reply) of the first machine to “ON”. Set to “OFF” for the other machines.
7. Operate the Matrix Switchers, controller (if used), RGB sources and RGB acceptors.
8. The inputs can now be switched to the outputs. This is done via the front panel switches of the **first** switcher, and/or via the external controller.

## 11 TAKING CARE OF YOUR MATRIX SWITCHER

Do not locate your Matrix Switcher in an environment where it is susceptible to dust or moisture. Both of these may damage the electronics, and cause erratic operation or failure. Do not locate your **Matrix Switcher** where temperature and humidity may be excessive. Doing so may also damage the electronics, and cause erratic operation or failure of your Matrix Switcher. Do not clean your Matrix Switcher with abrasives or strong cleaners. Doing so may remove or damage the finish, or may allow moisture to build up. Take care not to allow dust or particles to build up inside unused or open connectors.

## 12 TROUBLESHOOTING

### NOTES

1. Please note that if the output signal is disturbed or interrupted by very strong external electromagnetic interference, it should return and stabilize when such interference ends. If not, turn the power switch off and on again to reset the machine.
2. If the recommended actions still do not result in satisfactory operation, please consult your CVG Dealer.

### 12.1 Power and Indicators

Problem	Remedy
No power	<ol style="list-style-type: none"> <li>1. Confirm that the rocker switch is in the "ON" position, and that the lamp is illuminated.</li> <li>2. Confirm that power connections are secured at the machine and at the receptacle. Make sure the receptacle is active, outputting the proper mains voltage.</li> <li>3. If there is still no power, check the fuse. Remove power cord from the AC outlet and from the machine and then, using a flat screwdriver, remove the fuse holder located directly below the power connector. Confirm that the fuse is good by looking at the wire connected to the ends of the fuse. If the wire is broken, replace the fuse.</li> </ol>

### 12.2 Video Signal

Problem	Remedy
No video at the output device, regardless of input selected.	<ol style="list-style-type: none"> <li>1. Confirm that your sources and output device are powered on and connected properly. Video signals connected to the input of your machine should be of an identical signal format at the output of your source. Video signals at the output of your machine should be of an identical signal format as at the input of your display or recorder.</li> <li>2. Confirm that any other switchers in the signal path have the proper input and/or output selected.</li> <li>3. Use the Video Tester to test the video path leading to/from your Matrix Switcher (see section 4.1 " Video Tester")</li> </ol>
Video level is too high or too dim.	<ol style="list-style-type: none"> <li>1. Verify that the video line is well matched through 75ohm impedance, otherwise it results in a video level that is too high or too dim when looping is performed and the termination switches are not in proper position.</li> <li>2. Confirm that the connecting cables are of high quality, properly built and terminated with 75ohm BNC connectors. Check level controls located on your source input device or output display or recorder.</li> </ol>

Problem	Remedy
Noise bars are "rolling" up or down in the output image or: Low Frequency Hum in the audio output	Hum bars (ground loop) are caused by a difference in the ground potential of any two or more devices connected to your signal path. This difference is compensated by passing that voltage difference through any available interconnection, including your video cables.  <b>WARNING!</b> <b><i>Do not disconnect the ground from any piece of video equipment in your signal path!</i></b>  Check the following to remove hum bars: 1. Confirm that all interconnected equipment is connected to the same phase of power, if possible. 2. Remove equipment connected to that phase that may introduce noise, such as motors, generators, etc. 3. Disconnect all interconnect cables and reconnect them one at a time until the ground loop reappears. Disconnect the affected cable and replace, or insert an isolation transformer in the signal path.

### 12.3 Audio Signal

Problem	Remedy
No audio at the output device, regardless of input selected	1. Confirm that your sources and output device are powered on and connected properly. Audio signals connected to the input of your machine should be properly wired to the output of your source. Audio signals connected to the output of your machine should be properly wired to the input of your machine or recorder. 2. Confirm that any other amplifiers in the signal path have the proper input and/or output selected. Pay special attention to input amplifiers that may be built into your acceptor.
Audio level is too low	1. Confirm that the connecting cables are of high quality and properly built. Take special care in noting the wiring configuration of balanced to unbalanced cables. 2. Check level controls located on your source input device or output display or recorder.

### 12.4 Control

Problem	Remedy
No control of Matrix Switcher from PC software	1. Confirm the wiring of the connecting cable. This pin configuration may be found in Figure 4. Cable length should not exceed 25 feet. 2. Confirm that all DIP switches on the Matrix Switcher have been set properly. Keep in mind that if you are only controlling one Matrix Switcher on a specific port, that Matrix Switcher must be assigned the ID of "1". 3. Confirm that the baud rate of your computer COM port is set to the same as that of your Matrix Switcher (9600-Baud). Confirm that the proper COM port is selected in the control software. 4. Confirm that bi-directional communication is enabled on all Matrix Switchers. Please refer to Section 9.3.2 "Setting the Configuration Switches" for proper configuration for your Matrix Switcher. 5. With custom software, do not send multiple commands at the same time. The Matrix Switcher must complete one command and send the reply, before receiving another. 6. Confirm that the computer you are using supports true RS-232C protocol. Computers such as the Apple Macintosh do not!



## 12.5 Switching Malfunctions

Problem	Remedy
The switcher succeeds in switching a number of sources then fails to switch one.	<p>Malfunction in the particular source or cable assembly.</p> <p style="text-align: center;"><b>NOTE</b></p> <p style="text-align: center;"><i>The most common failure mode in transferring the signal of an audio source is a break in the connecting wire.</i></p> <p>Disconnect the source from a channel that is switching successfully and connect the suspect source to it. If the channel continues to switch successfully, then there is something wrong with the Matrix Switcher or the suspect source was not connected properly. If it does not continue to switch successfully, then there is something wrong with the source or cable assembly. Check them.</p>
The Matrix Switcher turns ON but will not switch at all	One of the two flat cables leading from the main board to the control board may be disconnected and the switch command is not being transferred to the Matrix Switcher. Check them.

## 13 COMMUNICATION PROTOCOL

Communication with the Matrix Switchers described in this manual uses four bytes of information as defined below. Data is transferred at 9600 baud with no parity, 8 data bits and 1 stop bit.

### 1<sup>st</sup> byte

	DESTINATION	INSTRUCTION					
0	D	N5	N4	N3	N2	N1	N0
7	6	5	4	3	2	1	0
MSB							LSB

### 2<sup>nd</sup> byte

				INPUT			
1	0	0	0	I3			
7	6	5	4	3			

### 3<sup>rd</sup> byte

				OUTPUT			
1	0	0	0	O3			
7	6	5	4	3			

### 4<sup>th</sup> byte

				MACHINE NUMBER			
1	0	0	0	0	M2	M1	
7	6	5	4	3	2	1	

#### **1<sup>st</sup> BYTE: Bit 7 – Defined as "0",**

This bit is always "low", when sending from the PC to the Matrix Switchers, and "high" for information sent to the PC.

#### **N5...N0 – "INSTRUCTION".**

The function that is to be performed by the Matrix Switcher (s) is defined by these 6 bits. Similarly, if a function is performed via the machine's keyboard, then these bits are set with the **INSTRUCTION NO.** which was performed. The instruction codes are defined according to the table below (**INSTRUCTION NO.** is the value to be set for N5...N0).

#### **2<sup>nd</sup> BYTE:**

**Bit 7 – Defined as "1".**

**Bits 4 – 6 - Defined as "0".**

**I3... I0 – "INPUT".**

When switching via RS-232 for RS-485 (for instruction codes 1 and 2), these bits set the input that is to be switched. Similarly, if switching is done via the machine's keyboard, then these bits are set with the input

number which was switched. For disconnect, set as 0. For other operations, these bits are defined according to the table.

**3<sup>rd</sup> BYTE:**            **Bit 7 - Defined as "1".**

**Bits 4-6 Defined as "0".**

**O3 – O0 – “OUTPUT”.**

When switching via RS-232 or RS-485 (for instruction codes 1 and 2), the output to switch is set by these bits. Similarly, if switching is done via the machine’s keyboard, then these bits are set with the output number which was switched. For other operations, these bits are defined according to the table.

**4th BYTE:**            **Bit 7 – Defined as "1".**

**Bits 3-6 Defined as "0".**

**M2... M0 – “Machine Number”.**

**Machine Number = (DIP – Switch Code) + 1.**

INSTRUCTION		DEFINITION FOR SPECIFIC INSTRUCTION		NOTE
#	DESCRIPTION	INPUT	OUTPUT	
0	RESET MACHINE	0	0	1
1	SWITCH VIDEO	Set equal to video input to be switched	Set equal to video output to be switched (0=to all the outputs)	2
2	SWITCH AUDIO	Set equal to audio input to be switched	Set equal to audio output to be switched (0=to all the outputs)	2
3	STORE STATUS	Set as SETUP #(1-8) or (1-6 for the CVG-606XL)	- To store parameters - to delete setup	2,7
4	RECALL STATUS	Set as SETUP #(1-8) or (1-6 for the CVG-606XL)	Don't care	2,7
5	REQUEST STATUS OF A VIDEO OUTPUT	Set as SETUP #(1-8) or (1-6 for the CVG-606XL)	Equal to output number whose status is read	3,7
6	REQUEST STATUS OF AN AUDIO OUTPUT	Set as SETUP #(1-8) or (1-6 for the CVG-606XL)	Equal to output number whose status is read	3,7
7	VIS SETTING	Don't care	- for immediate switching - for VIS switching	2
8	BREAKAWAY SETTING	Don't care	- for audio-follow-video - for breakaway	2
9	NOT USED			
10	REQUEST VIS SETTING	Set as SETUP #(1-8) or (1-6 for the CVG-606XL)	Don't care	3,7
11	REQUEST BREAKAWAY SETTING	Set as SETUP #(1-8) or (1-6 for the CVG-606XL)	Don't care	3,7
12 to 14	NOT USED			
15	REQUEST WHETHER SETUP IS DEFINED	Set as SETUP #(1-8) or (1-6 for the CVG-606XL)	Don't care	4
16	ERROR/BUSY	Don't care	Don't care	5
17	RESERVED			6
18	RESET MACHINE	0	0	1
19	STORE STATUS	Set as SETUP #(1-8) or (1-6 for the CVG-606XL)	0-to store parameters 1-to delete setup	2,7,9
20	RECALL STATUS	Set as SETUP #(1-8) or (1-6 for the CVG-606XL)	Don't care	2,7,10
21 to 56	NOT USED			
57	SET AUTO-SAVE	for auto save 0 – no save	Don't care	8,2
58 to 60	RESERVED			
61	IDENTIFY MACHINE	1 or 2 – machine name 3 or 4 – version	Don't care	11

**NOTES ON THE ABOVE TABLE:**

**NOTE 1** - When the master switcher is reset, (e.g. when it is turned on), the reset code is sent to the PC. If this code is sent to the switchers, it will reset according to the present power down settings.

**NOTE 2** - These are bi-directional definitions. That is, if the switcher receives the code, it performs the instruction, and if the instruction is performed (due to a keystroke on the front panel), then these codes are sent. For example:

0000 0001  
1000 0101  
1000 1000  
0011

was sent from the PC, then the switcher (machine # 3) will switch input 5 to output 8. If the user switched input # 1 to output # 7 via the front panel keypad, then the switcher will send:

0100 0001  
1000 0001  
1000 0111  
1000 0011     ⇒ to the PC.

When the PC sends one of the commands in this group to the switcher, then, if the instruction is valid, the switcher replies by sending to the PC the same four bytes that it sent (except for the first byte, where the DESTINATION bit is set "high").

**NOTE 3** - The reply to a "REQUEST" instruction is as follows: the same instruction and INPUT codes as were sent are returned, and the OUTPUT is assigned the value of the requested parameter. The replies to instructions 10 and 11 are as per the definitions in instructions 7 and 8 respectively. For example, if the present status of machine number # 5 is breakaway setting, then the reply to

0000 1011                     Would be ⇒                     0100 1100  
1000 0001                     0100 0001  
1000 0000                     1000 0001  
1000 0101                     1000 0101

**NOTE 4**-The reply to the "REQUEST WHETHER SETUP IS DEFINED" is as in TYPE 3 above, except that here the OUTPUT is assigned with the value 0 if the setup is not defined; or 1 if it is defined.

**NOTE 5**-An error code is returned to the PC if an invalid code was sent to the switcher (e.g. trying to save to a setup greater than 8, or trying to switch an input or output greater than the highest one defined). This code is also returned to the PC if an RS-232 instruction is sent while the machine is being programmed via the front panel. Reception of this code by the switcher is not valid.

**NOTE 6**-This code is reserved for internal use.

**NOTE 7**-SETUP #0 is the present setting. SETUP #1 to SETUP# 8 are the settings saved in the switcher's memory, (i.e. those used for Store and Recall).

**NOTE 8**-Under normal conditions, the machine's present status is saved each time a change is made. The "power-down" save (auto-save) may be disabled using this code. Note that whenever the machine is turned on, auto-save function is set.

**NOTE 9**-This is identical to instruction 3 (machine uses instruction 3, when sending to PC).

**NOTE 10**-This is identical to instruction 4 (machine uses instruction 4, when sending to PC).

**NOTE 11**-This is a request to identify the switcher/s in the system. If the INPUT is set as 1 or 2, the machine will send its name. The reply is the decimal value of the INPUT and OUTPUT. For example, the reply to the request to send machine name (for machine number 001) would be:

0111 1101  
1000 1000 (i.e. 128 + 8)  
1000 1000 (i.e. 128 + 8)  
1000 0001

If the request for identification is sent with the INPUT set as 3 or 4, the appropriate machine will send its software version number. Again, the reply would be the decimal value of the INPUT and OUTPUT - the INPUT representing the number in front of the decimal point, and the OUTPUT representing the number after it.

For example, for version 3.5, the reply would be:

0111 1101  
1000 0011 (i.e. 128 + 3)  
1000 0101 (i.e. 128 + 5)  
1000 0001

**TABLE OF HEX CODES FOR THE MASTER CVG-808xl**

The table below shows the “HEX” codes for switching the master CVG-808xl.  
 The table is also valid for the CVG-606xl if the last two rows and columns are ignored.

	<b>OUT 1</b>	<b>OUT 2</b>	<b>OUT 3</b>	<b>OUT 4</b>	<b>OUT 5</b>	<b>OUT 6</b>	<b>OUT 7</b>	<b>OUT 8</b>
<b>IN 1</b>	01	01	01	01	01	01	01	01
	81	81	81	81	81	81	81	81
	81	82	83	84	85	86	87	88
	81	81	81	81	81	81	81	81
<b>IN 2</b>	01	01	01	01	01	01	01	01
	82	82	82	82	82	82	82	82
	81	82	83	84	85	86	87	88
	81	81	81	81	81	81	81	81
<b>IN 3</b>	01	01	01	01	01	01	01	01
	83	83	83	83	83	83	83	83
	81	82	83	84	85	86	87	88
	81	81	81	81	81	81	81	81
<b>IN 4</b>	01	01	01	01	01	01	01	01
	84	84	84	84	84	84	84	84
	81	82	83	84	85	86	87	88
	81	81	81	81	81	81	81	81
<b>IN 5</b>	01	01	01	01	01	01	01	01
	85	85	85	85	85	85	85	85
	81	82	83	84	85	86	87	88
	81	81	81	81	81	81	81	81
<b>IN 6</b>	01	01	01	01	01	01	01	01
	86	86	86	86	86	86	86	86
	81	82	83	84	85	86	87	88
	81	81	81	81	81	81	81	81
<b>IN 7</b>	01	01	01	01	01	01	01	01
	87	87	87	87	87	87	87	87
	81	82	83	84	85	86	87	88
	81	81	81	81	81	81	81	81
<b>IN 8</b>	01	01	01	01	01	01	01	01
	88	88	88	88	88	88	88	88
	81	82	83	84	85	86	87	88
	81	81	81	81	81	81	81	81

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